1.1.1.1.1.1 Chapter

2

2. Aircraft Operations

2.1 Basic aircraft structure

An understanding of the basic elements that make up the structure of most general aviation aircraft will help you understand how the aircraft is controlled. When executing search patterns, the mission observer should know the aerodynamic parts that cause the aircraft to turn, climb, and roll.

The basic aircraft control surfaces can be seen in Figure 2-1, along with a general aircraft design. The effects of aileron, elevator, and rudder movements can be seen in Figures 2-2 through 2-4.

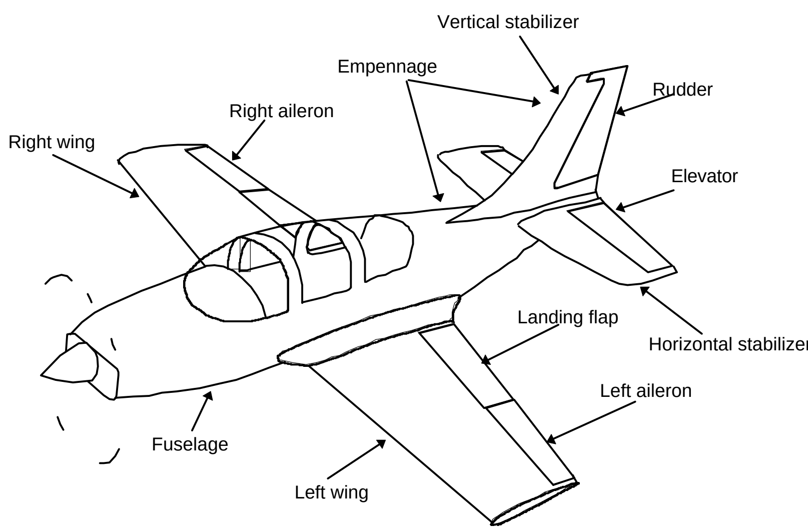


Figure 2-1

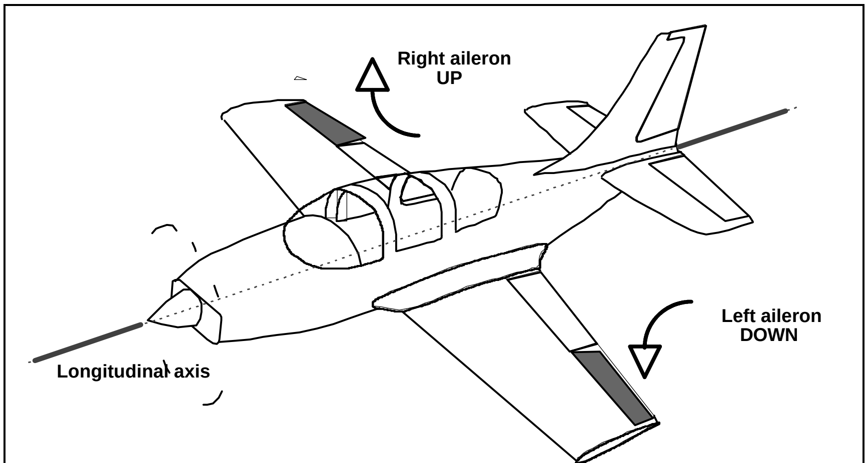


Figure 2-2

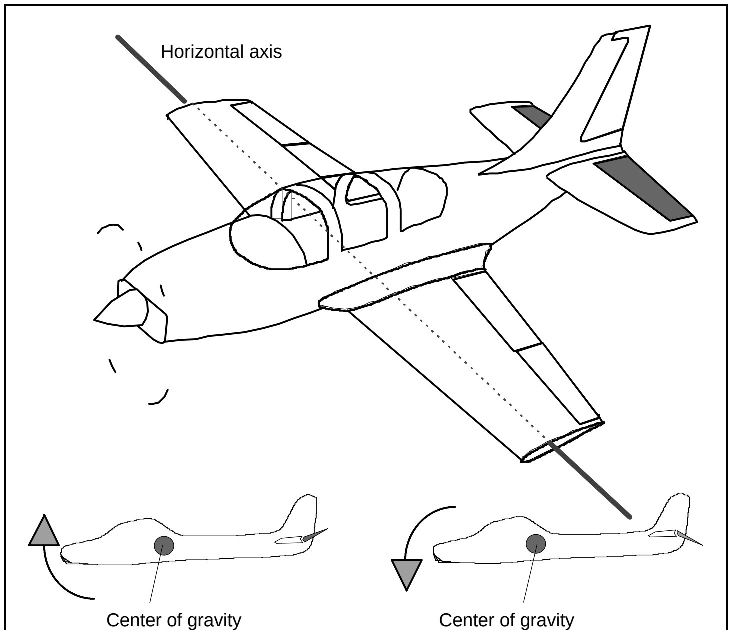


Figure 2-3

The basic structure of a conventional airplane is the fuselage, and all other parts are attached to it. This is true for most single-engine aircraft. The primary source of lift is the wing, while the other parts provide stability and control. The tail, or empennage, consists of the horizontal stabilizer with its attached elevators and the vertical stabilizer with its attached rudder.

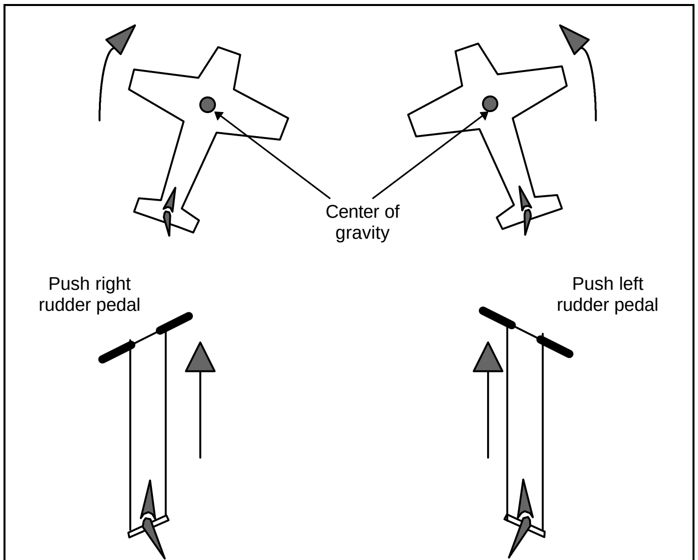


Figure 2-4

2.1.1 Ailerons

Ailerons are movable surfaces attached to the trailing edge of the wing, toward the wing tip from the flaps. They control roll or movement around the longitudinal axis (Figure 2-2). When the aileron on one wing goes down, the aileron on the other wing automatically goes up. If the pilot wants to roll to the right, he moves the stick or turns the yoke to the right. The right aileron goes up (creating a loss of lift on the right wing) and the left aileron goes down (creating more lift on the left wing), which results in a roll to the right.

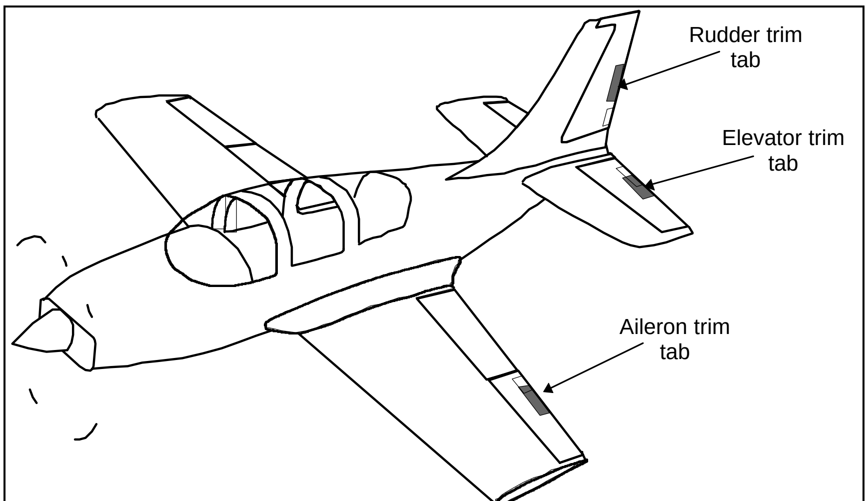


Figure 2.5

2.1.2 Elevator

An elevator is a control airfoil attached to the trailing edge of the tail's horizontal stabilizer. It controls pitch, or movement around the horizontal axis (Figure 2-3). When the yoke is pulled back, the elevators are raised. The raised elevators and the actions of relative winds cause a downward force on the tail and thus raises the nose. The relative wind causes an opposite action when the yoke is pushed forward by the pilot.

2.1.3 Rudder

The rudder is an airfoil attached at the trailing edge of the tail's vertical fin. It is designed to control the yawing, or side-to-side action around the vertical axis (Figure 2-4). The action is controlled through right and left pedals at the pilot's feet. If he pushes the left pedal, the rudder swings to the left. This action, along with the actions of relative winds, creates a force that pushes the tail to the right. The nose of the aircraft then moves (yaws) to the left.

2.1.4 Trim tabs

A trim tab is used for fine control. It is an auxiliary surface attached to trailing edges of airfoils (Figure 2-5). When a continuous but slight pressure on the controls is required for straight and level flight, the pilot might adjust a trim tab to get the proper balance and be free from exercising continuous control on a long, tiring flight. Small knobs or wheels in the cockpit are provided to effect some of these adjustments in flight. Other tabs are adjustable only when the aircraft is on the ground. If the pilot lands and reports tail, nose, or wing heaviness, the remedy might be an adjustment of the tabs according to the need. Trim tabs are sometimes combined in one way or another with balancing tabs and flying tabs.

This brief look at the basic structure of an airplane does not explain all there is to know about the control surfaces. With this familiarization you should be able to recognize these parts and understand in a general way how they function.

2.2 Aircraft instruments

2.2.1 Magnetic compass

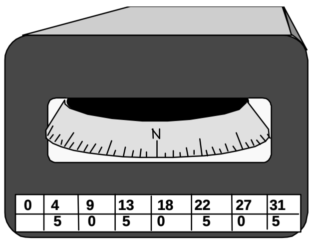


Figure 2-6

The magnetic compass (Figure 2-6) shows the aircraft's heading in relationship to the earth's magnetic North Pole. This instrument requires no power, so it can be used even in the event of complete electrical system failure. However, it is not as stable as gyro-driven heading indicators, and does not show heading well during turns. It also is affected by the metal structure of the aircraft and by the magnetic fields produced by electronic equipment. It is primarily used to calibrate the other heading systems and as a backup in case they fail.

2.2.2 Directional Gyro

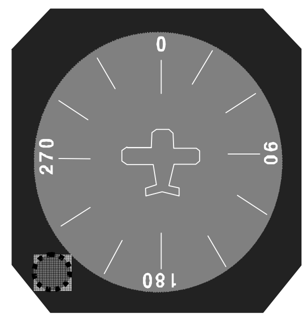


Figure 2-7

The directional gyro or heading indicator (Figure 2-7) is easier to use than the magnetic compass. Driven by a gyroscope, it provides a steady, reliable indication even during turns. Since gyroscopes can develop errors over time, this instrument must be aligned periodically during a flight. Normally aligned by the pilot manually, it may be automatically updated through a "slave" connection to a magnetic compass. The gyroscope that powers this instrument is usually driven by a vacuum pump, but it may be electrically powered.

Figure 2-8

2.2.3 Altimeter

The altimeter (Figure 2-8) shows pressure altitude, and is usually set to show altitude above Mean Sea Level (MSL). If the local barometric pressure is not set in the instrument, the altitude reading will not be correct.

2.2.4 Turn Coordinator

The turn coordinator (Figure 2-9) is two instruments in one. The miniature aircraft indicates the rate at which the aircraft is turning. The ball on the bottom is the slip indicator, which indicates whether the aircraft is flying straight or is yawed to one side or another.

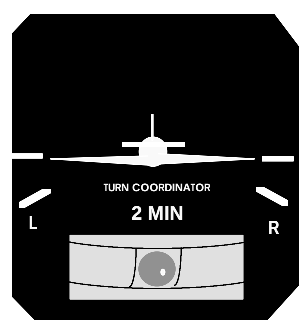


Figure 2-9

2.2.5 Airspeed indicator

Figure 2-10

The airspeed indicator (Figure 2-10) shows how fast the aircraft is moving through the air. It may be calibrated in statute miles per hour or in nautical miles per hour (knots). There are colored arcs around the outside of the dial indicating certain operating limits for the aircraft. These may include flap operating range, normal operating range, and maximum speed. Refer to the pilot's operating handbook for a complete description of the colored arcs and their meaning.

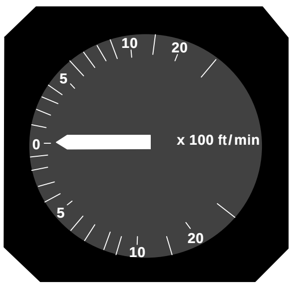


Figure 2-11

2.2.6 Vertical speed indicator

The vertical speed indicator (Figure 2-11) indicates the rate at which the aircraft is climbing or descending. It is usually calibrated in feet-per-minute. This instrument is most often used while flying in instrument conditions, but may also be referenced at other times. Because of its design, it has a 1- or 2-second lag before an accurate indication is displayed.

2.2.6A Attitude Indicator

The attitude indicator (Figure 2-12), sometimes called the "artificial horizon," is designed to show the attitude of the aircraft. It is primarily used in instrument flying.

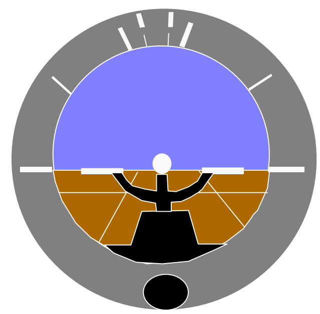


Figure 2-12

2.2.7 Engine instruments

Figure 2-13

Each aircraft may have a different set of engine instruments. These may include a tachometer to show engine speed in revolutions-per-minute (Figure 2-13), oil pressure gauge, oil temperature gauge, and cylinder head temperature to name a few. Many engine instruments have colored arcs to show normal operating ranges.

2.3 *Weight and Balance*

You will often hear the phrase "weight and balance" used in conjunction with preflight planning. Aircraft are designed to operate within specific design criteria, and exceeding these criteria can have devastating consequences. This section will discuss these issues in general terms. For information relating to weight and balance for a specific make and model of airplane, you should refer to the aircraft's flight manual.

2.3.1 Weight

The force of gravity continually attempts to pull the aircraft toward the ground. The only force that counteracts weight is lift. The amount of lift produced by an airfoil is limited by airfoil design, angle of attack, airspeed, and air density. Therefore, you must avoid overloading the aircraft to ensure sufficient lift is generated to counteract the weight. If aircraft weight exceeds the manufacturer's recommendations, the aircraft will be either unable to take off or it may exhibit unexpected and potentially lethal flight characteristics.

Every item on the aircraft contributes to its weight. Each aircraft is weighed after production and the figures are recorded in the maintenance log. When extra equipment, such as radios or other instruments, is added to the aircraft, the aircraft's weight is adjusted in the logbook. This figure is commonly referred to as "empty weight." For each flight, the pilot computes further increases in the weight for other items required for that flight. The first of these is oil and fuel for the engine. Aviation fuel weighs approximately 6 pounds per gallon, so this is a very important consideration. If a large load (i.e., people and luggage) must be carried in the aircraft, the pilot may elect to only partially fill the fuel tanks. This, of course,

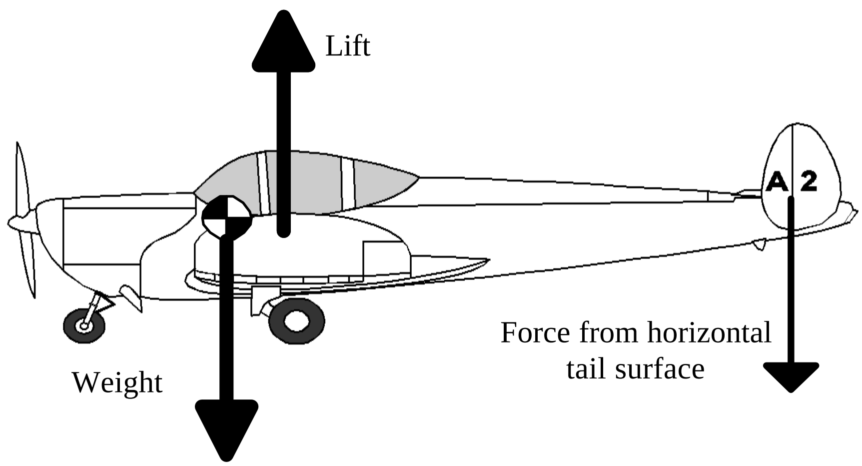


Figure 2-14

limits range and must be done very carefully because the fuel gauges are not very accurate.

2.3.2 Balance

Balance refers to the location of the center of gravity (c. g.) of an airplane and is critical to airplane stability and safety of flight. While gravity obviously affects the entire aircraft, for computations it can be assumed that the aircraft's weight is concentrated at the center of gravity. Figure 2-14 shows that gravity pulls down on the center of gravity, and the wings produce lift to counteract that force. The horizontal tail surface produces lift in a downward direction to balance weight and lift and keep the aircraft level. The pilot can change the force created by the horizontal tail by deflecting the elevator, which causes the nose of the aircraft to go up and down. The purpose of computing weight and balance before each flight is to ensure that the horizontal tail can generate enough lift to balance the aircraft and provide sufficient pitch control. The pilot controls the balance of the aircraft by calculating the center of gravity and loading the airplane to keep the c. g. within limits.

If the c. g. is not adjusted properly before flight, it can affect the stability of the aircraft. Modern civilian aircraft are designed to be stable in flight. This makes the aircraft safer and easier to operate. Positive pitch stability causes the aircraft to stay in a stable pitch attitude without constant manipulation of the controls, and pitch stability depends on the location of the c. g. in relationship to the center of lift. If the aircraft is loaded "tail heavy," the center of gravity will move aft toward the center of lift, and the aircraft will become less stable.

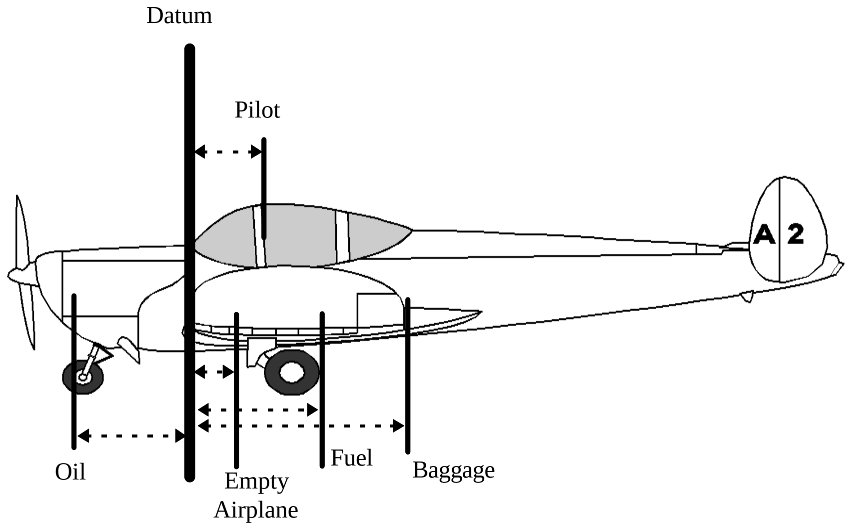


Figure 2-15

Incorrect balance can also affect the control of the aircraft. The elevator on the horizontal stabilizer is used to vary the force on the tail and thereby change the pitch attitude of the aircraft. If the aircraft is loaded "nose heavy," it could result in a condition where the horizontal tail surface cannot generate enough force to raise the nose. This is especially noticeable at the slow airspeeds that are used during takeoff and landing, and that is the worse possible time to discover you have a balance problem.

The manufacturer establishes C.G. limits. There are fore and aft limits beyond which the c. g. should not be located for flight. For some airplanes, the c. g. limits, both fore and aft, may be specified to vary as gross weight changes. They may also be changed for certain operations, such as acrobatic flight.

Every item in a balance problem has two components, a weight and a moment arm. Even the empty aircraft has both of these components. The moment arm is the item's distance from a specified point on the aircraft called the datum. In civilian aircraft the datum is often located at the aircraft's firewall, but that is not always the case. Figure 2-15 shows the parts of a typical balance problem. The pilot begins with the weight and moment arm of the empty airplane, then makes changes for the oil, fuel, passengers and baggage. The result must fall within the published limits for the aircraft, or something will have to be moved until the c. g. falls within those limits.

2.3.3 Computing weight and balance

Computing weight is very simple. The pilot starts with the documented empty weight of the aircraft and adds the weight of any items that are loaded for the flight. This figure should not exceed the published maximum gross weight for the aircraft.

Computing balance is a little more involved. Each item's weight and moment arm must be used to determine whether the loaded aircraft falls within the manufacturer's limits. Here's an example problem:

Item	Weight	Moment / 1,000
Empty airplane	1340	51.6
Oil	15	-0.3
Pilot and front passenger	320	11.2
Fuel	240	11.6
Rear seat passenger	300	21.6
Baggage	60	5.5
Totals	2,275	101.2

The moment for each item is determined using another chart in the aircraft manual. Then, the total weight and moment are used to enter the chart shown in Figure 2-16 and determine whether the aircraft is properly loaded. In this case, the aircraft falls within the c. g. envelope for normal operations.

Notice the moment arm for the oil is a negative value. This happens because

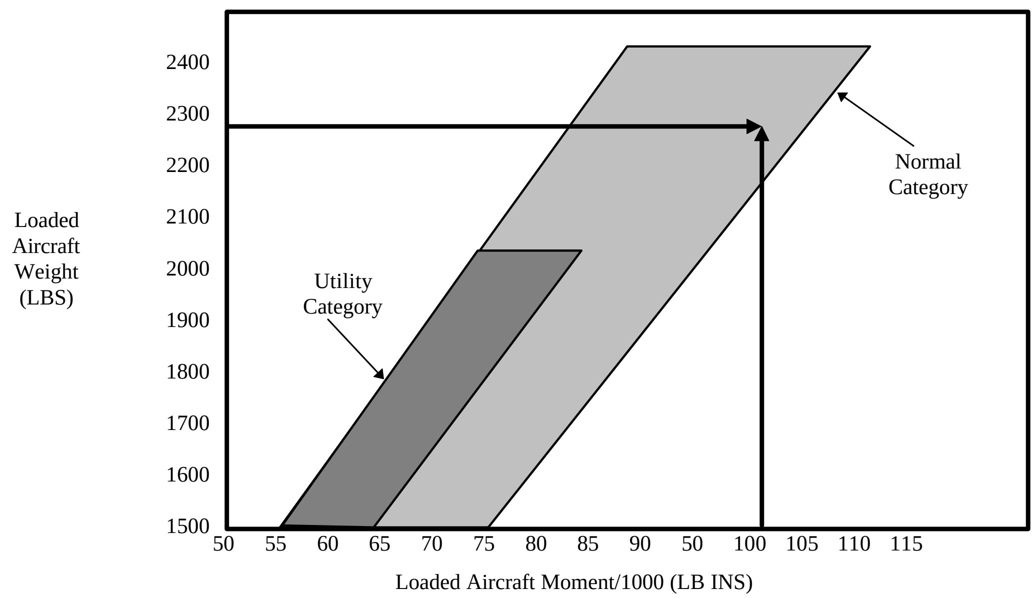


Figure 2-16

the datum for this aircraft is located at the firewall and the oil is located in the engine, which is in front of the firewall. The moment for the oil is subtracted from the total moment, and all other calculations proceed as normal.

2.4 Pre-flight inspection

The act of preflighting an airplane is no more than a safety check and evaluation of the craft's condition for the flight. This is the pilot's responsibility, and exactly how it is done will depend on the pilot's individual routine. Normally, the rest of the aircrew stands well clear as this preflighting process is carried out. If you are asked to help, you probably will call out each item on the checklist. When the pilot has examined the item called out she will give a signal such as "check" or "O.K." This means the pilot is ready for the next item to be called out. This method of checklist accomplishment is called “challenge and response.”

The walk-around inspection is the major portion of the pre-flight. Figure 2-17 shows the major parts of the aircraft that are included in the pre-flight inspection. A visual inspection will be made to see if any of the aircraft's major parts are defective. Condensation can occur in the fuel tanks, and water in the aircraft’s fuel can result in a reduction or complete loss of power. Aircraft fuel tanks have a drain at the bottom, and the pilot will extract a small amount of fuel from each tank and inspect it for contamination.

Fuel gauges sometimes malfunction, so a visual check of the fuel quantity is accomplished. The pilot removes the fuel filler caps and visually verifies that each

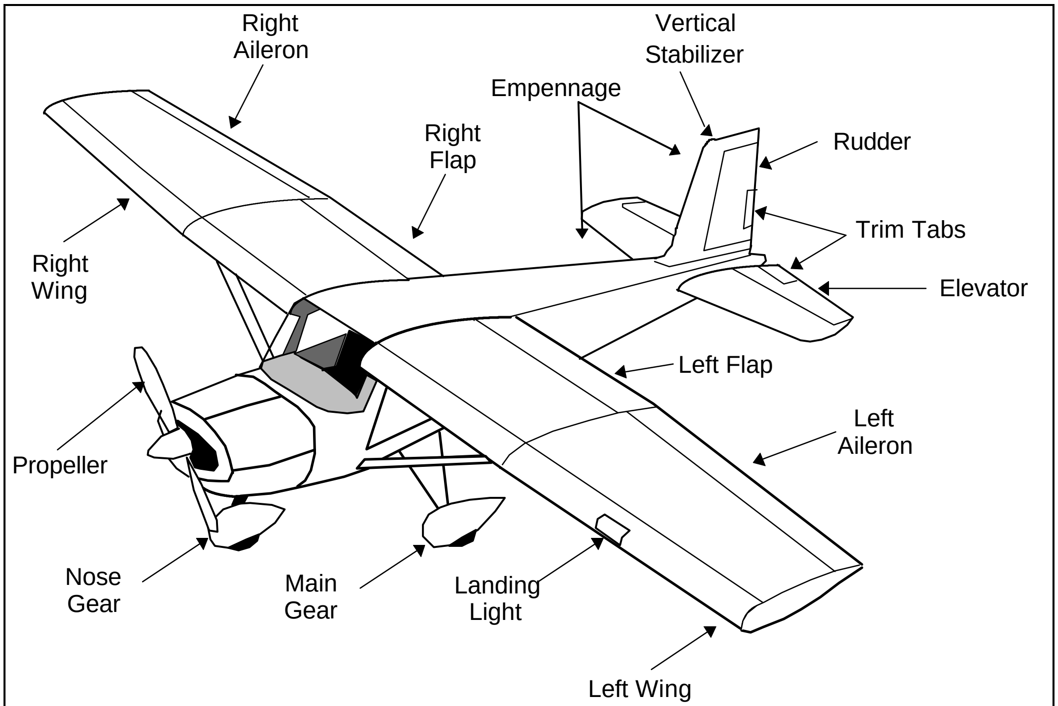


Figure 2-17

tank is filled (normal procedure is to fill the tanks upon completion of each sortie). As the walk-around continues, every movable, attached part will be tested for freedom of movement. Also, hinges will be scrutinized closely to see that they are fully in place and not worn thin.

The propeller and its attachment points receive careful attention. A large nick or hairline crack in a propeller could cause it to fail in flight. There are may other items to check as the pilot continues the walk-around inspection. When it is completed you will be instructed to board the airplane. Remember to fasten your seat belts and shoulder harness securely.

The preflight checks will continue after the crew is in the airplane. Other checklists are followed to start the engine, adjust radios and electronic navigation equipment (navaids), check flap settings, etc. This "before takeoff" checklist must be completed before taking the runway. This checklist is used to ensure that the engine is working properly, the controls are free, and that the control surfaces (ailerons, elevator, and rudder) are moving in the right directions. In addition to what is on the checklist, every pilot will take a last-minute look at certain items before the actual takeoff is started.

2.5 Safety

Safe activity in the vicinity of aircraft depends on everyone knowing certain "do's" and "don'ts." Memorizing a list of what one should and should not do is desirable, but everything that could happen in a situation cannot be contained in a list. So, knowing certain basics is only a beginning; from this point on the person must remain observant and practice safety! Distractions and hurrying are part of a sure formula for mistakes.

In addition to remembering some very important do's and don'ts and thinking safety, it is good practice to be courteous. The Civil Air Patrol and individual aircraft owners who lend their craft to SAR missions have a lot of money invested. Remember that some of the equipment on aircraft is fragile, and all of it is expensive. Because of this, owners are very protective of their property. Your demonstration of respect for their property will cause them to accept you quickly as one of the team.

California Wing C-182 crashes; 2 killed, 1 injured

CALIFORNIA - Two California Wing members were killed and one injured Nov. 1 when the Civil Air Patrol C-182 they were flying crashed about 75 miles south of Reno, Nev. The two crew members who died in the crash were both assigned to the San Jose Senior Squadron out of San Jose, Calif.

Injured was Captain Joseph Smith, who was assigned to the Jon E. Kramer Composite Squadron out of Palo Alto, Calif. Captain Smith was found at the crash site and immediately transported to the University of California, Davis Medical Center in Sacramento. He was listed in fair condition with burns on his hands and face.

The aircrew was searching for a missing Cessna 206 with four on board when their aircraft went down in a remote wilderness area in the Toiyabe National Forest.

Civil Air Patrol News - November 1997

2.5.1 No smoking

You will see "No smoking within 50 feet" signs at aviation gasoline pumps. This distance is necessary because of the possibility of igniting gasoline fumes. Such signs will not be displayed on SAR aircraft, but the same rule applies. Why? All aircraft have fuel overflow pipes through which gasoline may spill onto the ground when heat causes it to expand. As the gasoline evaporates its fumes may travel in any direction. Therefore, an open flame anywhere near the airplane could cause the airplane to catch fire.

The best or safest precaution is to forget about smoking when you are anywhere near aircraft or gasoline pumps, or better yet, anytime you are on the flight line. There should be specially designated smoking areas at your mission headquarters. If so, use them. After all, they were designated for a special purpose - to avoid the loss of valuable property and, possibly, lives.

2.5.2 Keep clear

You should always remember that an aircraft that is moving on the ground (taxiing) is a dangerous vehicle. You could be injured if struck by any part of the airplane, but the propeller is a real killer. The propeller spins so rapidly it is invisible most of the time, and this may be part of the explanation of why so many people have been killed by propellers. Still another part of the explanation must be that the victims were not paying attention to what they were doing - they were not thinking!

The airplane does not have to be moving for its propeller to be spinning. When a pilot starts the engine the propeller starts spinning. Before the airplane begins to taxi, the pilot lets the engine run to "warm up" while he makes adjustments to radios and other items in the cockpit. The reverse process takes place when the airplane is brought in at the close of the sortie. The airplane is stopped, but the engine remains running, and the propeller spins until the pilot completes his post-flight checklist. Engine shutdown is one of the last items on this checklist, so the engine may run for several minutes after the airplane stops moving. Also, due to the design of an aircraft's electrical system, it is possible (although improbable) for an engine to start by itself. Therefore, it is safest to avoid touching or standing close to a stopped propeller.

Remember, keep well clear when an airplane is moving or when its engine is running. Always stay clear of the propeller, even if it is stopped. Do not enter or exit an aircraft while the propeller is spinning. Also, watch out for the trailing edges of the wings, flaps, and ailerons as they are sharp and are often right at head level. You should take extra care when moving around the aircraft and looking at some other item of detail.

2.6 Ground Operations

Aircraft, unlike automobiles and other vehicles, seem very flimsy to us. Actually they are <u>extremely</u> strong, but only when the loads and forces acting on them are applied in the amounts and directions for which their designers intended. Other forces and loads can easily cause minor or major damage to the aircraft. Due to the complexity of their structure, even minor damage can be very expensive to repair.

When ground handling and pushing an airplane, never push or pull on control surfaces or the propeller. Never push the aircraft at any point that has "No Push" painted on it. For the majority of CAP aircraft (C-172s and C-182s), use the struts to move the airplane (remember to check the brakes first).

Also, don't rotate, hold, or stand near the propeller. Aircraft ignition systems are designed differently from those in cars, and even slight propeller movement, especially when the engine is still warm, can sometimes cause the engine to "fire" momentarily, hurting anyone in the propeller's path. Few individuals survive being struck by a propeller.

When loading the aircraft, ensure all loose items are stowed or secured. In moderate to severe turbulence, loose objects in the airplane cabin can suddenly become projectiles that can hurt cabin occupants or damage the aircraft. If the aircraft is equipped with cargo nets or cargo straps, use them.

Be very careful where you step when boarding or exiting the aircraft. Most aluminum wing skin will *not* support the weight of even a small adult without dimpling or distorting. On low-wing aircraft, like the *Cherokee,* the portion of the wing that *will* support such weight is usually covered with black or gray nonskid material and is known as the wing walk. On high-wing aircraft, like single-engine Cessnas, never step on the pod or "pant" that covers each main wheel and tire assembly. Wheel pants and mounting supports are not designed to be used as steps, and will be bent or damaged if used as such. You may also see parts of the aircraft labeled “No Step” and “No Handhold.” It is very important to follow the warnings given by these placards.

Entering or exiting an airplane while the engine is running is <u>highly</u> discouraged. Exiting an aircraft while the propeller is moving is very dangerous, as you may slip and fall into the propeller. If you must board while the engine is running, make sure the pilot has you in sight and approach the airplane from behind the wing. Always remain in the pilot’s sight. Also, propellers can throw up dust and dirt even when spinning at idle power settings, so eye protection is recommended for those individuals that must board the airplane while its engine is running.

Always wear seat belts in the aircraft. FAA and CAP regulations require all occupants to wear seat belts and shoulder harnesses anytime the aircraft is moving on the airport surface, and during takeoff or landing. Once airborne, you may remove the shoulder harness, but it makes good sense to leave it loosely fastened in case unexpected turbulence is encountered. Also, don’t touch anything in the aircraft, especially knobs and switches, unless you are familiar with its purpose and use.

Using a headset is recommended for in-flight noise protection. If you don’t have a headset, use earplugs.

While taxiing the aircraft, all crewmembers should watch in all directions for any obstacles that might contact and damage the airplane, such as other airplanes, fuel trucks, signs, or fence posts. Frequently, in crowded parking areas, it may be necessary for the pilot to taxi the airplane near an obstruction. The crew should obtain the assistance of a "wing walker" or outside observer to visually confirm the airplane will clear the obstruction without contact. Ground crewmen use hand signals to help pilots during taxi operations. Those signals are located in CAPR 55-1, and can also be found at the end of this chapter.

All crewmembers must be alert to prevent the CAP aircraft from taxiing closely behind any large aircraft, either jet or prop, which has its engines running. Thrust produced by the operating engines, even at very low power settings, can blow a light airplane out of control or even tip it over. Rotor down wash from an operating helicopter can have similar disastrous effects.

2.6.1 Don't touch

Some of the courtesy we spoke of earlier can be extended to aircraft owners by never touching their aircraft. Looking and admiring is fine, but never touch an airplane unless the pilot or pilot/owner gives permission for you to do so. When inside the airplane, consider the "don't touch" rule to be doubled. This is especially true for any of the knobs, levers, and cranks. Many of these items have been set or adjusted for safe flight. If you move any of them and the pilot happens not to check them before flight, there could be some embarrassing moments for all. This "don't touch" rule will be relaxed as you become more familiar with the airplane. You will get a type of on-the-job training from the pilot. You may eventually be asked to help with the preflight and post-flight tasks.

As a general rule, the action to take in case of fire on the ground is to get away from the airplane. Whether you should run is a matter of judgment. After all, the fire may be a very small one that is confined to the engine compartment. If this is the case, the fire could be extinguished if action is taken quickly. Each airplane has a fire extinguisher on board, so make certain you know where it is located and you know how to operate it. Remember, however, to use your head. If there is a small fire, but gasoline is pouring out of the fuel tanks, and if it isn't necessary to help other members of the aircrew get away, you should get away from the aircraft as fast as safely possible.

2.6.2 Getting into and out of the airplane

Do not step on an aircraft's wing or other part where there is no black, non-skid material attached. Sometimes there won't be any non-skid material on what is clearly a step. If there is any doubt, ask the pilot. Also, the pilot probably will say where and when to exit the airplane after it has come to a full stop and the engine has been shut off.

Always approach airplanes from the rear for entry and depart toward the rear. Remember that the front of the airplane is the business end. This is where the dangerous propeller is located.

The first thing that one should do upon taking a seat in any aircraft is to adjust your seatbelt and shoulder harness. The seatbelt should remain fastened until the flight is completed and you are ready to get out of the airplane. In flight, especially low-level flight, there is most always some degree of air turbulence. You want to bounce through the air with the airplane. If the seat belt is not fastened you will find yourself bouncing around in the cockpit! Even when taxiing, there is the possibility of a sudden stop.

2.6.3 Fire

As a general rule, the action to take in case of fire on the ground is to get away from the airplane. Whether you should run is a matter of judgment. After all, the fire may be a very small one that is confined to the engine compartment. If this is the case, the fire could be extinguished if action is taken quickly. Each airplane has a fire extinguisher on board, so make certain you know where it is located and how to operate it. Remember, however, to use your head. If there is a small fire, but gasoline is pouring out of the fuel tanks, and if it isn't necessary to help other members of the aircrew escape, you should get away from the aircraft as fast as safely possible.

In summary, here are a few checklist items that can help increase the margin of safety during aircraft operations:

- Plan all flights carefully and completely.

- Brief passengers concerning normal and emergency procedures.
- File flight plans for all flights outside of local area.
- Do a thorough preflight inspection prior to each flight.
- Make sure you are using current checklists.

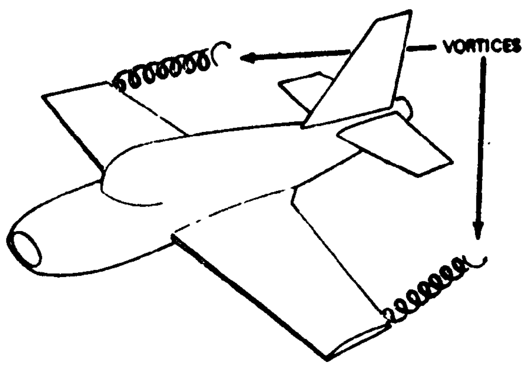


Figure 2-18

- Use standard hand signals during taxi operations.
- Chock main gear wheels fore and aft whenever the aircraft is parked.
- Make sure the aircraft is tied down at the end of each day, with the avionics/gust lock installed.
- Ground aircraft properly before refueling.
- Drain fuel tank sumps before flight.
- No smoking on the flight line.
- Know how to use safety equipment on and around aircraft.
- Know where the fire extinguisher is and how to use it.
- Have a fire extinguisher on the ground near the aircraft during refueling.
- Use seat belts while the aircraft is in operation.
- Know ramp procedures.
- Wear shoulder harness if they are installed in the aircraft.

2.7 Wake turbulence

Wake turbulence is the disturbance of air caused by a large airplane's movement and is sometimes called “used air.” This is a major cause for concern to all air crew members. It develops when normal air movement is disrupted by the motion of the aircraft structure, particularly at the wing tips. Higher pressure air beneath the wing continuously "spills" upward and around the tip to the lower pressure area above the wing. This creates a spiral vortex that, if visible, would resemble a horizontal tornado. Figure 2-18 depicts the generation of wing-tip vortices by an aircraft.

The amount of wake turbulence is directly related to the amount of lift the aircraft's wings must produce. All aircraft wings, even the lightest ones, produce some amount of wake turbulence, but it is not normally a danger unless the aircraft creating it is large, or heavy, and its wings are creating lift.

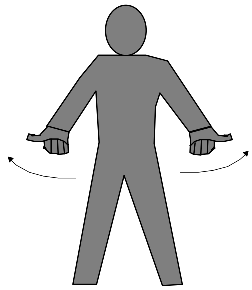
Vortex strength varies with the size, speed, and shape of the wing. Large or "jumbo" jets create the most severe wing-tip vortices when they are taking off or landing. In a no-wind condition, the vortices spread outward and away, and sink beneath the parent aircraft where normal atmospheric turbulence eventually disperses them. Vortices may remain active well after the aircraft that spawned them has passed. The duration of activity depends on the stability of the atmosphere at vortex level.

The FAA has studied wake turbulence and has published avoidance procedures for light aircraft pilots. The agency recommends that, when taking off behind a large jet, you wait several minutes for the vortices to disperse. The pilot should also make certain that the small plane lifts off the runway well before reaching the point where the jet's nose wheel lifted. This is because a large airplane does not generate strong vortices until its wings are making lift, which generally begins at nose wheel lift-off. When landing behind a large jet, the small plane should stay well above the jet's flight path and land beyond the jet's touchdown point. Once the jet's main and nose wheels are on the pavement, the wings produce only negligible lift and wing tip vortices.

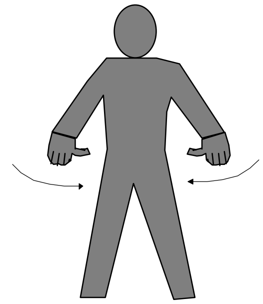
Operations from parallel runways can also be dangerous. Surface winds may blow wake turbulence into your path.

Wake turbulence is also a consideration to CAP aircrews while in flight, particularly when at low altitudes in the vicinity of an airport. Light aircraft must stay clear of the area behind and below the larger aircraft. The pilot of the smaller airplane should climb to an altitude above the large airplane's flight path. One thousand feet below the larger aircraft's flight path is considered safe vertical separation for avoiding wake turbulence. The pilot might consider descending more to allow for misjudging the large aircraft's altitude, if uncertain. If it's not practical to climb or descend, the light aircraft pilot should slow or turn the aircraft as required to increase the distance between his aircraft and the larger airplane.

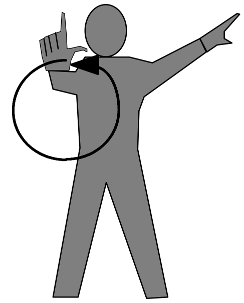
Air traffic controllers normally warn pilots of wake turbulence. They usually maintain 2-3 miles horizontal separation in flight, and require a three minutes wait for takeoff behind a heavy aircraft. However, it is the pilot’s final judgment to continue the takeoff or approach and landing.



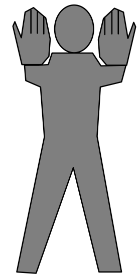
Outward motion with Thumbs - PULL CHOCKS



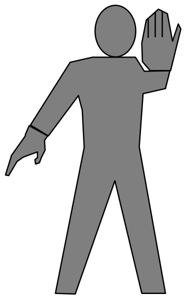
Inward motion with thumbs - INSERT CHOCKS



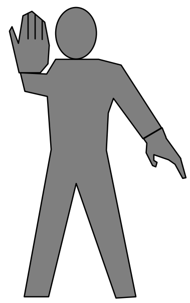
Circle with hand - START ENGINE



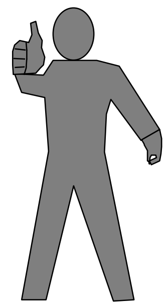
Hands out making a pulling motion - COME AHEAD



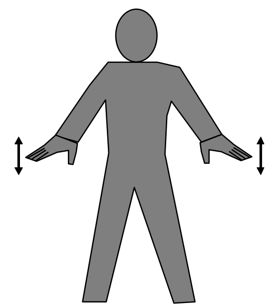
Motion forward, pointing left - TURN LEFT



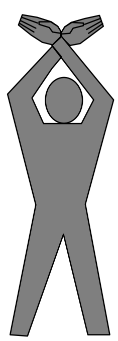
Motion forward, pointing right - TURN RIGHT



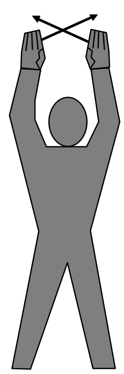
Thumbs up - ALL CLEAR - O.K.



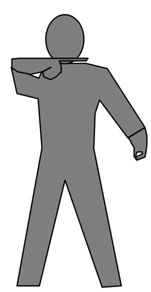
Downward motion with palms - SLOW DOWN



Hands crossed above head - STOP



Crossing hands over head - EMERGENCY STOP



Slash throat with finger - CUT ENGINE